

PREVENTION OF CORE BURSTS, CREPING, AND RIBBONS ON JUMBO ROLLS

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***PRACTICE-ORIENTED TESTING OF THE ROLL STRUCTURE CLOSE TO THE CORE
CAN BE DONE ON A TRANSPORTABLE TEST STAND.***

ROLLS OF LIGHT WEIGHT COATED (LWC) AND SUPER-calendered (SC) rotogravure papers for printing are becoming ever larger and heavier. Modern printing presses today run rolls of 3.6 m in width and 1.25-1.3 m in diameter. The roll weight is in the region of 5.5 tons, and even bigger rolls are planned for the future.

As roll weight has increased, complaints from printing houses of web breaks caused by core bursts, core creping, or core ribbons have also become more frequent. These breaks, which usually occur shortly before the automatic roll change, are responsible for substantial production losses (for waste clearance, web threading, or other causes).

Premature splicing, with a larger slab remaining on the roll, produces a considerably higher amount of broke and more difficult handling on removal of spent rolls.

The roll cores are made of cardboard. There are essentially two sizes of core, 76 mm and 150 mm inner diameter (for the roll dimensions mentioned above, only 150 mm cores are used). The cores have a wall thickness of approximately 15 mm. During printing, the paper roll is carried in the unwind of the printing press by expanding core chucks of approximately 200 mm in length.

The paper web is guided through the printing press during printing under tension. The unwinding roll must therefore be braked. In the large diameter range, this braking is performed with the aid of tapes. These tapes are pressed against the unwinding roll, and their speed

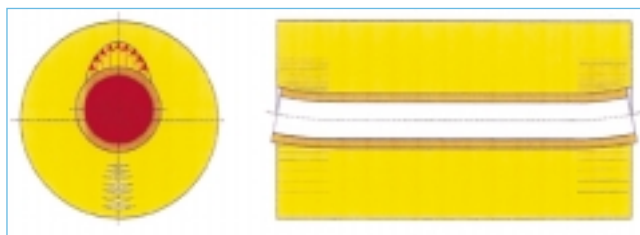
can be altered according to the required paper web tension. In the lower diameter range, the roll is braked by brake generators coupled with the center of the roll. On modern unwinds, the braking tapes are pressed against the roll from below; on older machines, from above.

The engagement force is around 15 kN. The force to be taken up by each of the two core chucks can be calculated from the dead weight of the roll and the engagement force of the braking tapes. On modern unwinds, this force is approximately 34 kN because the tapes are applied from below.

Since the cardboard cores only offer a limited degree of flexural stiffness, they bend inside the unwinding roll during unwinding. The amount of

deformation not only depends on the stiffness of the core but also on the winding hardness of the roll. The deformation of the core is responsible for the aforementioned forces not being distributed evenly over the core length; instead they are greatest around the edges of the roll, where they place a great deal of strain on the inner layers of paper on the core. During this process, the layers of paper currently on top are put under strain and the paper layers underneath are relieved. This results in the two ends of the core assuming an eccentric position in relation to the middle of the roll, as shown in Fig. 1.

As a result of the eccentric position of the core end, the movement in this area is similar to that of a planetary gear except that here the planetary gear wheel cannot turn freely. As a consequence, very high forces of friction occur in the area of contact between the paper layers lo-



1. Eccentric position of the two ends of the core in relation to the middle



2. Overall view of the test stand

cated above the load-bearing core chuck. During unwinding, these forces of friction can cause the dreaded crepe wrinkles, core bursts with ribbons of paper hanging out of the core, or both.

As mentioned above, the deformation of the core and its subsequent eccentric position also depend on the winding hardness of the roll. The greater the winding hardness, the smaller the degree of eccentricity and thus the smaller the risk of faults.

Paper rolls for modern printing presses are today produced virtually without exception on center-drum winders. The winding hardness of the rolls can be influenced on these machines through the following parameters:

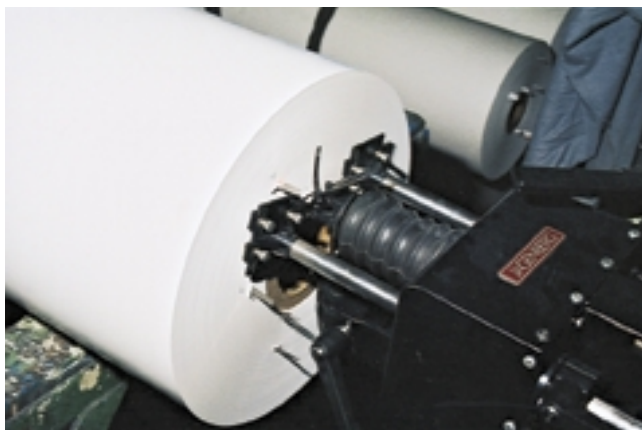
- Web draw
- Contact force between the roll and drum at the nip
- The torque introduced into the core.

Predicting the optimum parameters is no easy task, particularly when a new type of paper with different properties is to be run for the first time. The following factors have a major effect:

- The surface quality of the paper, which determines the friction coefficient between the layers of paper and thereby their ability to slip during winding and unwinding.
- The caliper profile over the web width. If the web happens to be thinner at the ends of a roll than in other areas, the zone with a thick profile prevents the web from being wound hard enough in the thinner area. In practice this has been proven to cause bursts.
- The compressibility of the paper. The paper is highly compressed and has virtually no capacity for further compression. As a result, it can only compensate for caliper fluctuations to a limited



3a. Winding up a roll center on the pilot winder



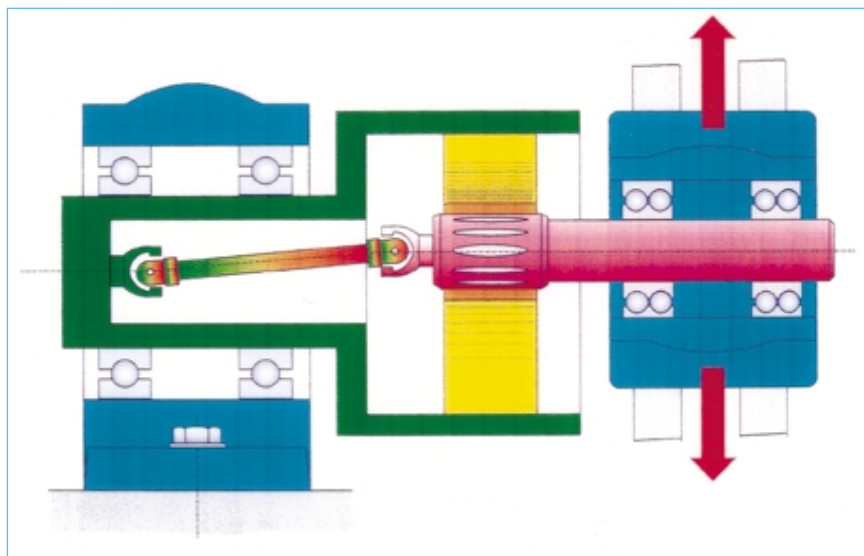
3b. Measuring the winding hardness with steel strips inserted into the roll



4. Narrow test rolls are sawn off the wide roll.

extent, even when the winder is set to extremely hard winding. The winder is not a calender!

With the aid of a transportable test stand, it is possible to identify the optimum machine parameters with relative



5. A gear motor drives the test piece with a cardan shaft in the unwind direction of the roll, simulating the unwinding on a printing press.

speed and at a viable cost. The test stand simulates the unwinding process on a printing press. **Figure 2** is an overall view of the test stand.

TEST SEQUENCE

The test sequence consists of the following elements:

1. Winding cores of approximately 400 mm in diameter on the machine winder, or
2. Producing wound cores on the Jagenberg pilot winder, as shown in **Fig. 3a**. The original paper and customer's cores must be provided. Here too, roll centers are produced under different operating data. In the trials on the pilot winder, the winding hardness is determined using JAG winding hardness measurement, as shown in **Fig. 3b**. Thin strips of steel are placed in the end of the roll during winding and pulled out by means of a measuring device after completion of the windup. The result is the JAG winding hardness, i.e., the pressure between the layers of paper, measured in N/cm² or bar over the wound diameter. This permits a direct comparison of the winding quality achieved in the various trials.
3. The ends of these core rolls are sawn off to a length of 120 mm, which corresponds approximately to the area borne by the printing press core chuck, as shown in **Fig. 4**.
4. These roll ends are fixed in the clamping halves of the tabletop device. Before they are clamped in, the diameter of the test piece must be reduced to an exact overdimension by cutting off. This ensures that the clamped test piece is under the same pressure (winding hardness) between the

steel clamping halves as in the jumbo roll.

5. The clamped test piece is now subjected to a force by means of an actuator system. The force corresponds to half the weight of the jumbo roll, i.e., exactly the force working on one side of the unwind in the printing press. The load applied by the tapes can be added or subtracted proportionately, depending on the type of unwind.
6. A gear motor drives the test piece via a cardan shaft in the unwinding direction of the roll and thus simulates unwinding on a printing press, as illustrated in **Fig. 5**.

The load cycle must always be the same to guarantee comparability of all tests in a series. (The Jagenberg cycle is 400 revolutions at 100 rpm = 4 minute trial duration.)

7. The results are evaluated on the basis of the layer slippage caused after application of the load, as shown in **Figs. 6a and 6b**. It is important to inspect both ends of the trial roll. This makes it possible to detect any differences in layer slippage at the two ends of a roll, caused, for example, by caliper variations in the paper web.

EVALUATION

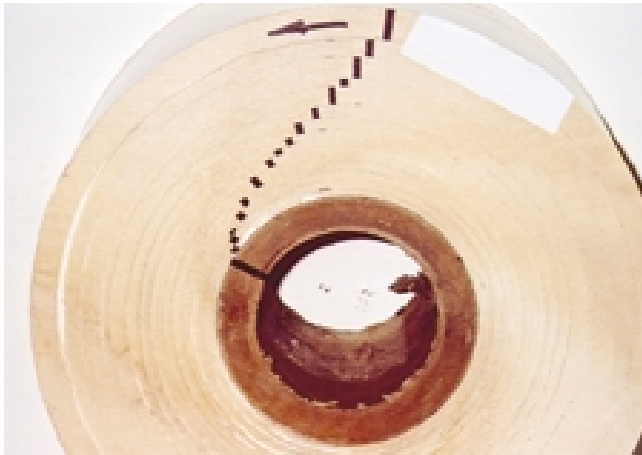
The following methods can be used to evaluate the test results:

- Number of jumps in layer slippage
- Total angle of rotation of layer slippage
- Unwinding the test piece and counting the number of crepe wrinkles and bursts. Here the occurrence of the wrinkles or bursts must be allocated to the diameter.

Generally speaking, the first two methods of evaluation produce clear results, making the time-consuming third method superfluous. This evaluation enables the optimum winder operating data for a given paper to be specified.

REMARK

When one is evaluating the tested roll ends, it must be borne in mind that the load applied to the 120 mm test piece is much higher than that on a wide original roll, since the forces in the latter case are not only borne by the last 120 mm of the core. This explains the higher



6a. Roll centers following the load test: poor result



6b. Good result of load test

number of slippage movements observed in comparison to the unwinding of an original roll under identical operating conditions.

This testing equipment has already provided excellent assistance to many manufacturers of SC and LWC jumbo rolls. Its employment involves virtually no loss of production time on site.

Direct production of jumbo rolls under different machine operating data is a poor alternative to the test, and feedback is received at a much later stage from the printer. This possibility, which is still practiced today, proves very costly. On the basis of the trials, the winder can be set up with the optimum parameters. As a result, core burst problems decline substantially—and with them the incidence of complaints from printing houses.

The benefits to the printer are these:

- Later roll change, meaning a smaller remaining slab
- Less broke
- Better handling with lighter spent rolls

- Higher productivity (e.g., less clearance time after web breaks). TJ

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